NON-PUBLIC?: N
ACCESSION #: 9212010125
LICENSEE EVENT REPORT (LER)

FACILITY NAME: RIVER BEND STATION PAGE: 1 OF 6

DOCKET NUMBER: 05000458

TITLE: REACTOR SCRAM DUE TO POWER SUPPLY FAILURE WITH DIVISION II
REACTOR PROTECTION SYSTEM PREVIOUSLY TRIPPED
EVENT DATE: 02/15/92 LER #: 92-001-02 REPORT DATE: 11/25/92

OTHER FACILITIES INVOLVED: DOCKET NO: 05000

OPERATING MODE: 1 POWER LEVEL: 100

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR SECTION:
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:
NAME: L.A. ENGLAND, DIRECTOR - NUCLEAR TELEPHONE: (504) 381-4145 LICENSING

COMPONENT FAILURE DESCRIPTION:
CAUSE: X SYSTEM: AA COMPONENT: RLY MANUFACTURER: A348
X IG JX G080
E EA 52 G080
REPORTABLE NPRDS: Y
Y
Y

SUPPLEMENTAL REPORT EXPECTED: NO

ABSTRACT:

At 2328 on 02/15/92 with the unit at 100% power (Operational Condition 1) a loss of power to average power average monitors (APRMS) "C" and "G" resulted in a trip of the Division I reactor protection system (RPS) and a reactor scram. The Division II RPS had been previously placed in the tripped condition due to the failure of a surveillance test on the scram discharge volume (SDV) water level instrumentation. Following the reactor scram, normal switchgear NPS-SWG1A failed to fast transfer to the preferred station service transformer, 1RTX-XSR1A. However, an automatic slow transfer to the preferred station service transformer was

successfully completed. This report is submitted pursuant to 10CFR50.73(a)(2)(iv), as an RPS actuation.

The reactor scram placed the unit in a safe shutdown condition and all safety systems functioned as designed. The failure of normal switchgear NPS-SWG1A to fast transfer to the preferred station service transformer, 1RTX-XSR1A, resulted in the loss of loads supplied by the normal switchgear, none of which are safety-related. All standby service water pumps functioned as designed and automatically started on low service water header pressure.

END OF ABSTRACT

REPORTED CONDITION

At 2328 on 02/15/92 with the unit at 100% power (Operational Condition 1) a loss of power to average power range monitors (APRMs) "C" and "G" resulted in a trip of the Division I reactor protection system (RPS) (*JE*) and a reactor scram. The Division II RPS had been previously placed in the tripped condition in accordance with Technical Specification 3.3.1 due to the failure of a surveillance test. This report is submitted pursuant to 10CFR50.73(a)(2)(iv), as an RPS actuation

INVESTIGATION

At 1957 on 2/15/92, the Division II RPS was placed in the tripped condition in accordance with Technical Specification (TS) 3.3.1 due to an unsuccessful performance of a surveillance test procedure (STP). This STP was a channel functional test of the scram discharge volume (SDV) water level - high instrumentation. The logic input to the RPS tested satisfactorily; however, the alarm function failed and the channel was declared inoperable. The loss of power to APRMS "C" and "G" resulted in a trip of Division I at 2328. With both Divisions in the tripped condition, a reactor scram followed immediately, per design.

Following the reactor scram, normal switchgear NPS-SWG1A failed to fast transfer to the preferred station service transformer, 1RTX-XSR1A. However, an automatic slow transfer to the preferred station service transformer was successfully completed. The transfer resulted in the loss of loads supplied by the normal switchgear, including normal service water pumps 1A and 1C, circulating water pumps 1A and 1C, instrument air compressor 1A, and reactor recirculation pump A. All standby service water pumps functioned as designed and automatically started on low service water header pressure.

GSU's investigation focused on the three major aspects of this event, as follows:

1. Scram Discharge Volume Instrumentation

GSU's investigation determined that the SDV water level instrumentation failure resulted from relay 1C71A-K1D not being fully inserted into its base. The relay was subsequently seated and the required channel functional test was successfully completed. Surveillance test procedure history data indicates that the last performance of STP-500-4505 occurred on January 16, 1992 with no adjustments required. Performance of this procedure verified that the relay was functional; however, it did not verify that the relay was properly inserted. Relay 1C71A-K1D is located in panel 1H13-P694 and is in an area difficult to access. Therefore, it is unlikely that normal

maintenance activities in this cabinet would have caused this relay to be moved or bumped. The root cause of this condition is indeterminate; however, a panel walkdown was performed to ensure no other relays were in like condition and none were found. A maintenance history review of this relay was performed and revealed no other reported problems.

2. APRM Power Supply

The investigation of the loss of power to APRMs "C" and "G" determined that power supply PS23 had failed. Initial analysis of the power supply revealed that an aluminum electrolytic capacitor had failed. The power supply was replaced and functional checks were satisfactorily performed. The power supply was within its required shelf-life at the time of installation and has been in service for a period less than its maximum operating life. No work was being performed on the APRM system at the time of the failure.

Aluminum electrolytic capacitors contain two aluminum electrodes with a dielectric that consists of an aluminum oxide layer on the anode electrode. This type of capacitor permits a small amount of dc leakage which is dependent on the value of the capacitor and the dc voltage applied. This characteristic changes as the capacitor ages and eventually results in failure of the capacitor. Since no external cause for the sudden catastrophic failure of the capacitor was apparent, the root cause of the failure was theorized to be excessive dc current leakage.

In order to ascertain a more definitive root cause, the failed power supply was returned to General Electric for failure analysis. This failure analysis followed refurbishment by the power supply manufacturer. The manufacturer submitted a report to GE which indicated that transistors Q15 and Q16 were shorted and that capacitors C8 and C9 were burned. The failure analysis noted that all capacitors were dry.

General Electric performed further failure analysis using the power supply schematic and this failure data. GE Engineering believes that only one of the two identified capacitors was burned. This is indicative of a short of the capacitor which caused the overheating. The shorting of one of the capacitors caused the failure of the two transistors. The failure analysis report also states that the condition of all capacitors being dry is indicative of normal aging as addressed in GE service information letter (SIL) 290.

The failure analysis states that the most likely mode of failure for an electrolytic capacitor is to lose electrolyte and decrease in capacitance. This was not the case for failure of C8 or C9. As a result of this event, RBS EQ and Specifications Engineering reviewed SIL 290, "Aluminum Electrolytic

Capacitor Aging" and reported that factors affecting capacitor failure include the quantity and composition of the electrolyte, effectiveness of the end seal, storage temperature and duration, operation temperature and duration, relative vapor pressure of the electrolyte, and operating voltage. Because of the number and types of variables contributing to the failures of aluminum electrolytic capacitors, failures (even end of life failures) occur randomly. GSU concludes that while a shorted capacitor is not a typical failure mode, this failure can be considered a random failure, due to the number and types of variables involved.

3. Failure to Fast Transfer

Investigation of the failure of 1NPS-SWG1A to fast transfer showed that breaker ACB11 failed to close as designed. The cause of the failure to close was binding in the breaker's cam follower roller and the small follower rollers. The binding was attributed to dried and hardened grease. During disassembly several bearings were found to be dry and required cleaning and lubrication. The condition of the grease appeared to be caused by contaminants. Contamination of grease has been an emerging issue in the nuclear industry. River Bend Station's initial preventive maintenance procedures for circuit breakers required a visual inspection of the breaker components and addition of grease as required.

These procedures have since been revised to include a visual inspection of the grease with requirements to notify the system engineer in cases where the grease exhibits anything other than a new appearance. Based upon the condition of the grease, the system engineer would recommend corrective action, including complete replacement of the grease. The failed circuit breaker had not received this upgraded preventive maintenance subsequent to the procedure revision.

ROOT CAUSE

Scram Discharge Volume Instrumentation

The high level alarm relay was not fully seated in its base. The root cause was indeterminate based on a maintenance history search and inspection of this and similar relays with no other deficiencies identified.

APRM Power Supply

The APRM power supply failed due to failure of an electrolytic capacitor. The failure analysis performed by GE states that either C8 or C9 shorted, leading to the shorting of transistors Q15 and Q16.

The failure of capacitors is caused by numerous variables as previously discussed. Neither the shelf life nor the service life of the failed power supply was exceeded. It is therefore concluded that the root cause of the power supply failure was random failure of an electrolytic capacitor.

Failure to Fast Transfer

The failure to fast transfer was due to failure of circuit breaker ACB11 to close as designed. The root cause of the breaker failure is that the failed circuit breaker had not received upgraded preventive maintenance subsequent to the preventive maintenance procedure revision. Corrective actions have already been implemented. Preventive maintenance procedures have been revised to include a visual inspection of grease condition and System Engineering notification anytime grease is found to be in less than new condition.

A review of previous LERS revealed no similar events.

CORRECTIVE ACTION

Scram Discharge Volume Instrumentation

A control room panel walkdown was performed to ensure all relays were fully inserted into their base. All relays were found to be fully inserted. STP-500-4505, "RPS - Scram Discharge Volume Water Level High, Monthly Channel Functional (C11-NG12D; C11-N601D)" was satisfactorily performed to prove operability of the SDV level instrumentation and alarm function.

APRM Power Supply

Following power supply replacement, the applicable surveillance procedures were satisfactorily performed to demonstrate operability of the APRM functions.

The failed power supply was sent to the vendor for failure analysis. The analysis showed that the failure was caused by a failed capacitor. RBS EQ and Specifications Engineering reviewed SIL 290 and concluded that the RBS procurement, shelf-life, and maintenance programs provide acceptable means for assuring that critical capacitors remain within their useful shelf-life, that failures will occur randomly, and that plant safety is not diminished.

Failure to Fast Transfer

Circuit breaker ACB9 was moved to the ACB11 cubicle. A spare breaker was moved into the ACB9 cubicle. Both breakers occupying ACB9 and ACB11 cubicles were then placed in normal plant lineup. To verify operability, fast transfer was successfully accomplished three times. To determine the magnitude of grease degradation and contamination, two Class 1E 4.16 KV breakers and five Cat II 13.8 KV breakers were visually checked. The grease in both the Class 1E and Cat II breakers was in acceptable condition. During refueling outage 4, all Class 1E breakers of this type were inspected and found to be acceptable. The 13.8 KV circuit breakers are non-safety related and serve non-safety related loads, and therefore are a reliability concern not a safety concern. Thirteen breakers on NPS-SWG1A and the spare breaker were inspected and found to have hardened grease. Breakers for the more critical non-safety related loads and the normal supply breaker which can not be worked during plant operation were completed. Additionally, the breakers which were found to have hardened grease were functionally tested and were found to operate properly with acceptable operating times

At this time seven of fourteen breakers on NPS-SWG1A (including the

spare) have been reworked. Rework of the alternate supply breaker and other load breakers will continue as conditions permit during the next operating cycle. The NPS-SWG1B rework is scheduled for the next refueling outage. These will be inspected and the work on these will be prioritized in a similar fashion beginning in the next refueling outage.

SAFETY ASSESSMENT

The reactor scram placed the unit in a safe shutdown condition and all safety systems functioned as designed.

The failure of normal switchgear NPS-SWG1A to fast transfer to the preferred station service transformer, 1RTX-XSR1A, resulted in the loss of loads supplied by the normal switchgear, none of which are safety-related. All standby service water pumps functioned as designed and automatically started on low service water header pressure.

GULF STATES UTILITIES COMPANY

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November 25, 1992

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U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, D.C. 20555

Gentlemen:

River Bend Station - Unit 1
Docket No. 50-458

Please find enclosed Licensee Event Report No. 92-001, Revision 2, for River Bend Station -Unit 1. This report is submitted to provide the results of the failure analysis of the average power range monitor (APRM) power supply. The remaining text in this report is current as of September 3, 1992.

Sincerely,

W.H. Odell
Manager - Oversight
River Bend Nuclear Group

LAE/JPS/FRC/DCH/DRC/kvm

ATTACHMENT 1 TO 9212010125 PAGE 2 OF 2

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ATTN: Administrator

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